

Subject: Annual Progress/Status report for award under NRA-97-MTPE-03,
with a work plan for 6 months extension into fy2002

Proposal/Project Title: EOS/CERES Surface Radiation Validation at NOAA Climate
Monitoring and Diagnostics Laboratory Field Sites

PI – Ellsworth Dutton, Co-PI – Barry Bodhaine (NOAA/CMDL, Boulder, CO)
303-497-6660, edutton@cmdl.noaa.gov

Period covered by Report: Oct. 2000 – Sept. 2001

Introduction

This project supports the collection and analysis of surface-based radiation budget observations at seven globally distributed sites operated by NOAA's Climate Monitoring and Diagnostics Laboratory (CMDL). These data are useful in support of validation efforts of the EOS/CERES SARB and Surface-Only programs as well as the ASTER, MODIS, and SAGEIII program. Since the NOAA surface sites are part of the WCRP Baseline Surface Radiation Program (BSRN), considerable supporting data in addition to surface irradiance are also acquired which are beneficial to understanding many of features radiative transfer in the earth's atmosphere. The data collected under this project have been directly utilized by the programs flying onboard the TRMM and Terra satellites. The network is intended to remain operation for the purposed of providing validation throughout the lifetime of Terra and is expected to be able to also integrate in with Aqua missions.

Objectives

The objectives of this project are to sustain and improve ongoing surface radiation measurement capabilities that produce data necessary for validation of various EOS algorithms and data products. The project was built upon existing activities that already covered much of the cost and necessary logistic support to obtain such data at globally remote sites. Fundamental to the project were the enhancements to the existing observational capabilities and augmentation of data processing and analysis to provide data on the rapid time scale desired by EOS.

A primary objective is to obtain surface irradiance data of sufficient quality and temporal resolution to meet the requirements of CERES and related climate research efforts. To help assure that such quality data were produced at the field sites supported in this project, these sites were upgraded towards satisfying the demanding specifications of the WCRP/BSRN program.

Accomplishments of the past year

The twofold thrust of this project was to implement current technology to supply best-available data at the time of satellite launch and to seek out and improve measurement capabilities as technology and instrument development evolves. Built on the sustained CMDL infrastructure, which already had several applicable surface locations operating, we were able to acquire and provide to EOS science teams data from several globally remote sites to help validate the first of the CERES satellites flown on TRMM through the present where data are being routinely supplied in of Terra sensors, primarily CERES. Details of the observational program and data being generated have been supplied in earlier progress reports. Work over the past year has involved a continuation of the data collection efforts, which include field operations, instrument calibration, data processing, data quality control and investigation into information content of the measurements. Specific tasks the past year were the integration of improved diffuse solar irradiance instrumentation as well as continued pursuit of developing universal, international measurement reference standards for thermal infrared and solar diffuse irradiance. Field program have and are being conducted a CMDL and ARM facilities the is promoting and perpetuating the necessary process in this endeavor, which benefit all surface radiation measurements, not just those specifically supported by the award.

Although the data from the CMDL surface radiation represents widely diverse geographical and climatological areas, a particularly unique and useful site is the CMDL site on Mauna Loa Hawaii. Because of its altitude 3.4 km and remote Pacific location, data obtained here are representative of the mid troposphere, and above, providing a frequent view of remote marine atmosphere free of the influences of the boundary layer. To assist in putting the current Mauna Loa measurements being used by the CERES project in perspective, an analysis of the historic solar irradiance measurements over the past 4 decades was completed with limits on potential trends and natural (quiescent and volcanically disturbed) variations being established.

Another supporting activity culminating in the past year was the development of a process to account for thermally induced offsets in certain solar diffuse measurements commonly being made by many groups. Although the adjustment of these offsets had been applied to all data supplied to the EOS project under this award, the publication and acceptance of our procedures is permitting other suppliers and users of similar data to implement the same procedures and thereby better homogenizing the combined radiation data products being used by the EOS community.

As in the past the work under this award is being integrated with other NASA funded efforts to provide highest quality surface radiation data to an even broader community, which includes radiative transfer and general circulation climate modeling. This goal is being fulfilled largely in cooperation with the World Climate Research Program, which has sponsored the Baseline Surface Radiation Network (BSRN). EOS related programs have benefited from the BSRN programs international archive that collects data from and international reservoir of nationally funded surface radiation measurement projects that are operationally standardized with the CMDL program supported under this award. It is anticipated that the BSRN program will continue into the foreseeable future.

Although only marginally funded by the award, the CMDL radiation program has continued to develop and deploy the capability to make spectral aerosol optical depth measurements and most of the field sites. These data are being calibrated and processed and will be available to EOS projects in the future.

Science Team Interaction

We have a strong working relationship with many members of the CERES science and management teams, supplying them with observational results and providing consultation on instrumentation and data interpretation. Ron Welch of the ASTER and CERES program science team is in the process of utilizing the CMDL radiation data. It is possible that some data from this project will be used by the MODIS and SAGEIII communities. There are occasional contacts with various members of the MODIS and SAGEIII science team members and utilization of the CMDL site data by these projects at some time in the future is likely. A representative of the CMDL group is in attendance at most CERES science team meetings and has provided assistance in the use and interpretation of the data supplied to their projects.

Planned Activities (Work Plan) and Budget for next 6 months

All data from the CMDL sustained surface radiation measurement project will continue to be made available the EOS program as in the past. Continued development of new universal measurement reference standards for the community as a whole will be pursued along with the maintenance of existing surface radiation measurements (list of specific measurements involved was supplied in earlier reports) at the globally diverse network of seven sites. This includes the data processing and evaluation of the resulting data prior release and all consultations with the EOS users, which has proved to be quite valuable in the past. Salaries for instrument maintenance, data processing and evaluation, as well as ongoing instrument development and improvements will constitute the bulk of the budget request for the coming six months. This will also aid the ongoing research efforts of the PIs which is concerned with an evaluation of the sources and causes of natural and anthropogenic variability in the fundamental component of climate forcing, the surface radiation budget. Support is also required for continued attendance at the CERES science team meetings and other interaction with EOS science team members. This interaction sometimes results in specialized requests for data requiring additional processing and evaluation to enhance the utility of the information in a PIs research, with this activity requiring additional labor expenditures. Other budget items are for minor supplies and resources as well as laboratory overhead.